299-E28-3 (A6786)

Log Data Report

Borehole Information:

Borehole:	299-E28-3 (A6786)		Site: Northeast of B Plant		
Coordinates (WA State Plane)		GWL (ft)[1]:	283.7	GWL Date:	3/28/2002
North	East	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
136,607 m	573,709 m	Jan. 1948	213 m (698.8 ft)	324	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Steel Welded	1.7	8.625	8.0	0.3125	0	324

Borehole Notes:

The logging engineer measured the casing stickup using a steel tape. Calipers were used to measure the casing wall thickness and the outside diameter; the inside diameter is calculated. Zero reference is the top of casing stickup. Top of casing stickup is rough and unevenly cut. Reference point survey "X's" were not located on the casing stickup. On 03/28/02, the borehole was swabbed. Radon was detected without smearable contamination. The maximum logging depth was 1 ft above the last measured groundwater level.

HWIS[3] is the source of the TOC elevation, and BHI (1998) is the source for the coordinates. Total depth (ground level reference) and casing bottom (TOC reference) are reported from information provided in Ledgerwood (1993). Approximately 15 ft east of this borehole, yellow and magenta radiation signs caution the presence of a buried pipeline. Twenty or more radiation signs are aligned north-south, marking the pipeline's route that parallels Baltimore Ave. starting from inside the B Plant's security fence and heading toward the BX Tank Farm.

Logging Equipment Information:

Logging System:	Gamma 2A		Type: SGLS (35%)
Calibration Date:	11/01/01	Calibration Reference:	GJO-2002-286-TAR
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	5
Date	04/24/02	04/25/02	04/30/02	05/01/02	05/03/02
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	89.5	140.5	185.0	282.5	196.5
Finish Depth (ft)	2.0	88.5	139.5	195.5	184.5
Count Time (sec)	100	100	100	100	100
Live/Real	R	R	R	R	R
Shield (Y/N)	N/A[4]	N/A	N/A	N/A	N/A
MSA Interval (ft)	0.5	0.5	0.5	0.5	0.5

Log Run	1	2	3	4	5
ft/min	N/A	N/A	N/A	N/A	N/A
Pre-Verification	BA137CAB	BA138CAB	BA140CAB	BA141CAB	BA143CAB
Start File	BA137000	BA138000	BA140000	BA141000	BA143000
Finish File	BA137175	BA138104	BA140091	BA141174	BA143024
Post-Verification	BA137CAA	BA138CAA	BA140CAA	BA141CAA	BA143CAA
Depth Return Error (in.)	0	+1	0	+1.2	N/A
Comments	Fine-gain adjustment and logging note below.	Fine-gain adjustment notes below.	Fine-gain adjustment notes below.	No fine-gain adjustments.	No fine-gain adjustments.

Log Run	6/Repeat	7/Repeat			
Date	05/03/02	05/03/02			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	98.0	48.0			
Finish Depth (ft)	82.0	32.0			
Count Time (sec)	100	100			
Live/Real	R	R			
Shield (Y/N)	N/A	N/A			
MSA Interval (ft)	0.5	0.5			
ft/min	N/A	N/A			
Pre-Verification	BA143CAB	BA143CAB			
Start File	BA143025	BA143058			
Finish File	BA143057	BA143090			
Post-Verification	BA143CAA	BA143CAA			
Depth Return Error (in.)	N/A	-1.2			
Comments	Repeat section. No fine-gain adjustments.	Repeat section. No fine-gain adjustments.			

Logging Operation Notes:

Zero reference was the top of casing. Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT verifier with SN 082.

During the SGLS logging, fine-gain adjustments were necessary to maintain the 1460-keV (^{40}K) photopeak at a pre-described channel. During log run 1, 04/24/02, fine-gain adjustments were made after files BA137064, BA137096, BA137113, BA137135, and BA137159. Also during logging run 1, the logging program wrote -27.10 ft when the correct depth was 77.5 ft for file BA137024. The cause of this depth error is unknown. On 04/25/02, during log run 2, fine-gain adjustments were made after files BA138010, BA138019, BA138067, and BA138075. On 04/30/02, during log run 3, a fine-gain adjustment was made after file BA1400052.

Unresolved waste management issues prevented logging below the current groundwater level.

Analysis Notes:

Analyst:	Sobczyk	Date:	06/10/02	Reference:	MAC-HGLP 1.6.3, Rev. 0

SGLS pre-run and post-run verification spectra were collected at the beginning and end of each day. The verification spectra were all within the control limits. The peak counts per second (cps) at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were within 6 percent of one another at each spectrum's energy line. The post-run verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC Supervisor.

Spectra for the SGLS were processed in batch mode using APTEC Supervisor to identify individual energy peaks and determine count rates. Concentrations were calculated in EXCEL (source file: G2ANov1.xls), using parameters determined from analysis of recent calibration data. Zero reference was the top of the casing. The casing configuration was assumed to be one string of 8-in. casing with a thickness of 0.322 in. to the maximum depth of the log. A casing thickness of 0.322 in. is the published value for ASTM schedule-40 steel pipe (a commonly used casing material at Hanford). This casing thickness is within the range of measurement error associated with the logging engineer's measurements. A water correction was not needed or applied to the SGLS data. Dead time corrections were not needed because dead time did not exceed 10.5 percent.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it appears to be less affected by the presence of radon in the borehole.

Results and Interpretations:

^{137}Cs was the only man-made radionuclide detected in this borehole. ^{137}Cs was detected near the ground surface (2.0- and 2.5-ft log depth) at activities ranging from 0.4 to 1.5 pCi/g. At 35.0 and 157.5 ft, ^{137}Cs was detected with an activity near its MDL of about 0.2 pCi/g. At 106.5 ft, ^{137}Cs was detected with an activity near its MDL of about 0.3 pCi/g.

Recognizable changes in the KUT logs occurred in this borehole. An increase in apparent ^{40}K activities of about 5 pCi/g occurs from about 19 through 32 ft. A slight increase in total gamma and apparent ^{232}Th activities occurs at 32 ft. Apparent ^{40}K activities appear to change by about 3 pCi/g at about 156-, 200-, 237-, 261-, and 276-ft log depths with corresponding changes in total gamma.

The behavior of the ^{238}U log suggests that radon is present inside the borehole casing. This effect is observed in log runs 1, 2, and 3 (2.0 through 185.0 ft). The effects of radon appear to be minimal in the other log runs. Radon daughters such as ^{214}Bi may also "plate" onto the sonde itself. When this occurs, there is a gradual increase in total counts as well as photopeak counts associated with ^{214}Bi and ^{214}Pb. This phenomenon appears to best explain the observed ^{238}U values in log runs 1, 2, 3, and the repeat log runs. The presence of radon is not an indication of man-made contamination; it is derived from decay of naturally occurring uranium. As a gas, radon moves easily in the subsurface, and concentrations of radon and its associated progeny can change quickly.

Aside from the effects of radon observed on the ^{238}U log (609 keV and 1764 keV), the plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the naturally occurring radionuclides. Due to the presence of radon in the borehole during log run 2, the repeat ^{238}U log in the interval from 88.5 to 98 ft appears to detect lower activities based on the 609-keV photopeak. At 35.0 ft, ^{137}Cs was detected with an activity near its MDL of about 0.2 pCi/g on the original log and not on the repeat log.

The gross gamma profile from Additon et al. (1978) (attached) indicates gamma-emitting contamination in the sediments surrounding this borehole was probably not present at the time of the log. The profile from 5/17/63 does not appear to detect gamma activity above background in the borehole.

Because of waste management issues, MACTEC-ERS was unable to log beneath the water table in this well. The 216-B-5 Reverse Well is located about 475 ft northeast of well 299-E28-3, where alkaline, low-salt, radioactive liquid wastes from B Plant were discharged to groundwater between 1945 and 1947 (Smith 1980). During this period, about 31 million liters of liquid waste containing 80.7 Curies of ^{137}Cs was discharged (Brown and Rupert 1950).

The SGLS should be used to log the interval below the current groundwater level (282.5 to 324 ft) in this well and in nearby wells. Logging in the groundwater is essential in fully characterizing the contamination associated with the 216-B-5 Reverse Well, which is a representative site for the 200-TW-2 Tank Waste Group Operable Unit (DOE 2000). Both Brown and Rupert (1950) and Smith (1980) constructed detailed maps and geologic cross-sections showing the distribution of gamma-emitting radionuclides in the aquifer. Logging beneath the water table in the vicinity of the 216-B-5 Reverse Well will supply data that are fundamental to determining mobility of ^{137}Cs in groundwater under field conditions, also allowing direct comparison to data collected during the past 50 years (Brown and Rupert 1950; Smith 1980). The waste generated by SGLS logging is small, and a waste management plan is in place (DOE 2000).

References:

Additon, M.K., K.R. Fecht, T.L. Jones, and G.V. Last, 1978. *Scintillation Probe Profiles From 200 East Area Crib Monitoring Wells*, RHO-LD-28, Rockwell Hanford Operations, Richland, Washington.

Bechtel Hanford, Incorporated (BHI), 1998. *Hanford Site Atlas*, BHI-01119, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.

Brown, R.E. and H.G. Rupert, 1950. *The Underground Disposal of Liquid Wastes at the Hanford Works, Washington*, HW-17088, General Electric Hanford Company, Richland, Washington.

Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-East Resource Protection Wells*, WHC-SD-ER-TI-007, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Smith, R.M., 1980. *216-B-5 Reverse Well Characterization Study*, RHO-ST-37, Rockwell Hanford Operations, Richland, Washington.

U.S. Department of Energy (DOE) 2000. *200-TW-1 Scavenged Waste Group Operable Unit and 200-TW-2 Tank Waste Group Operable Unit RI/FS Work Plan*, DOE/RL-2000-38, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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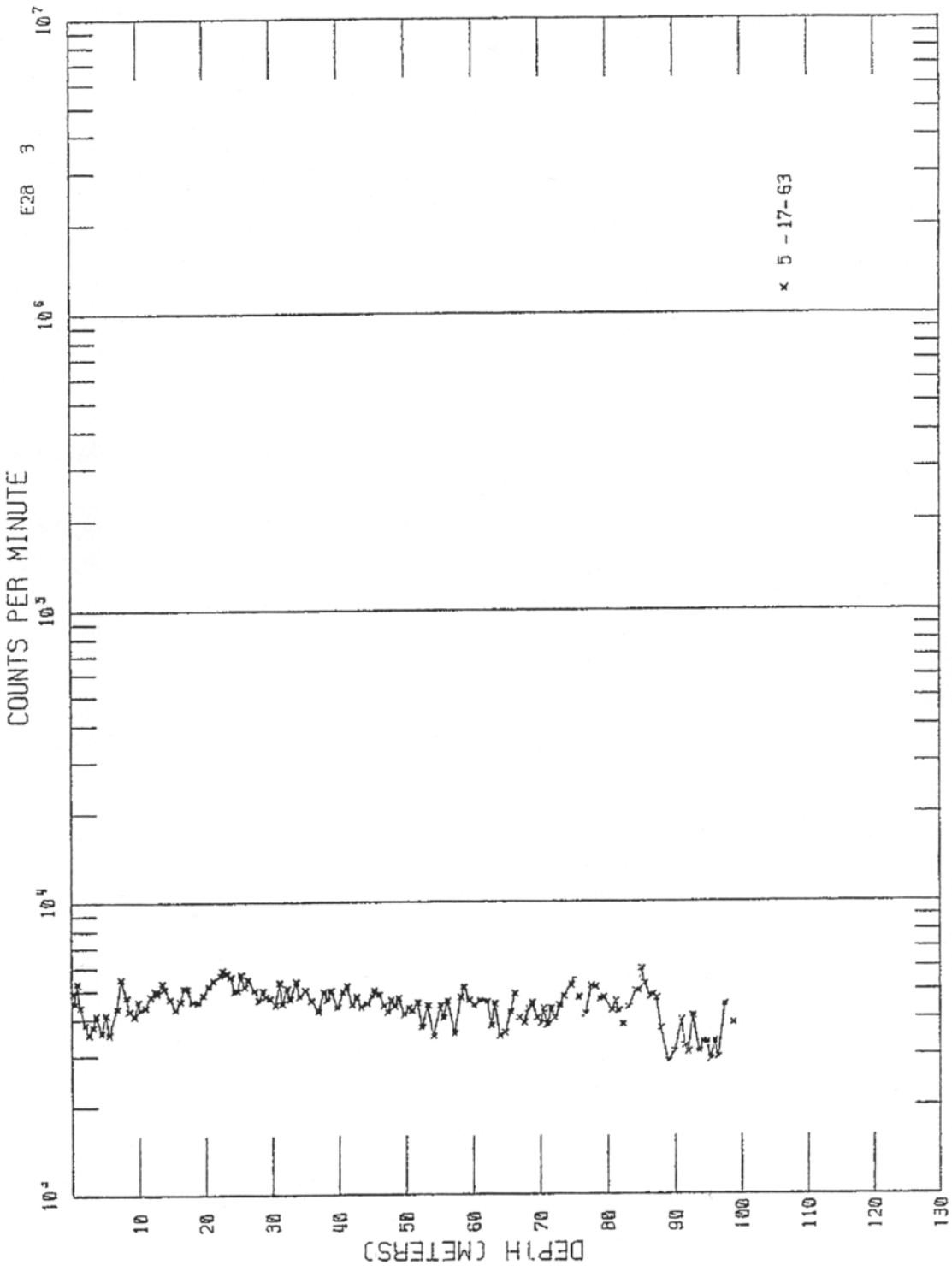
[1] GWL – groundwater depth
[2] TOC – top of casing
[3] HWIS – Hanford Well Information System
[4] N/A – not applicable



from Additon et al. (1978)

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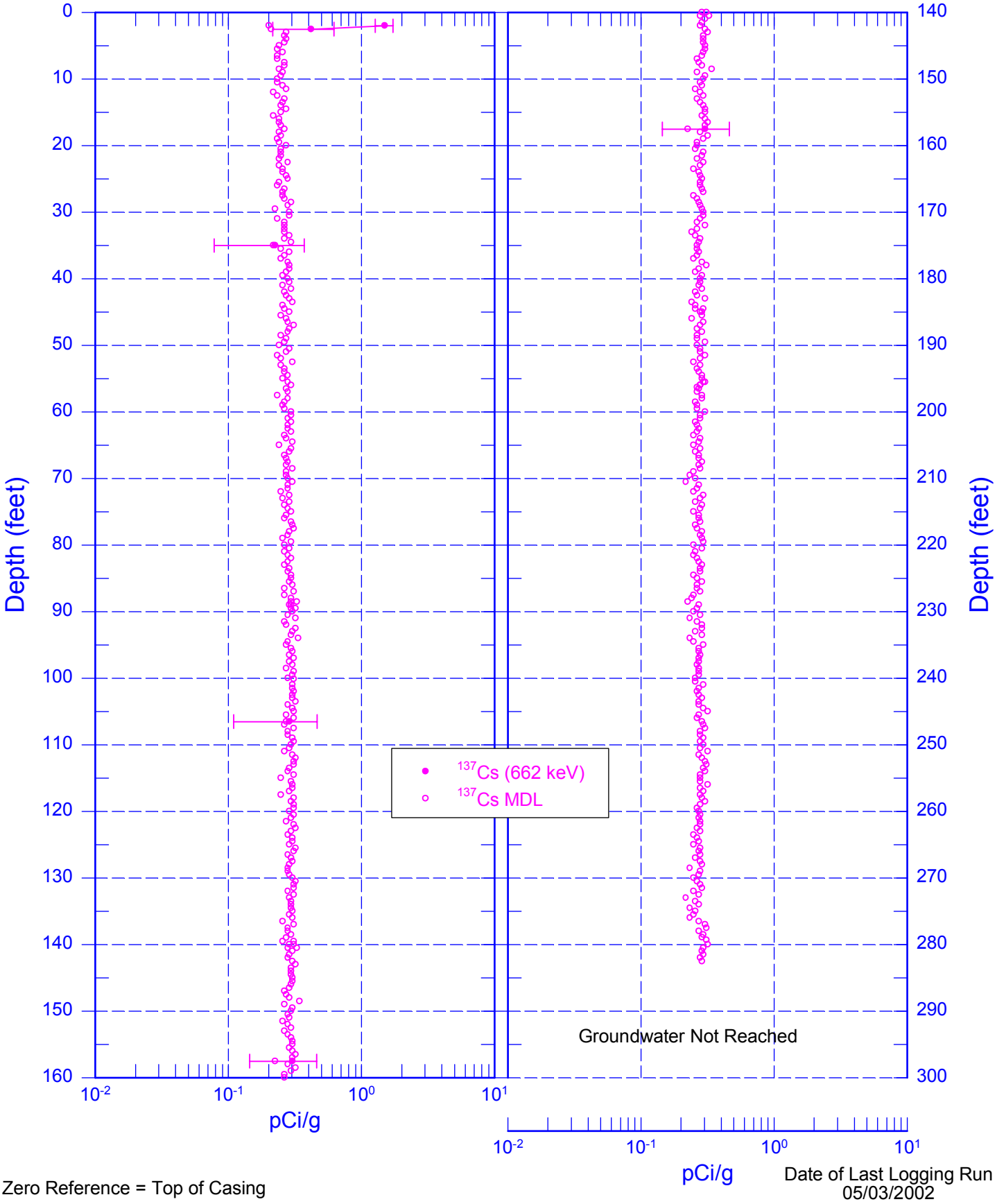
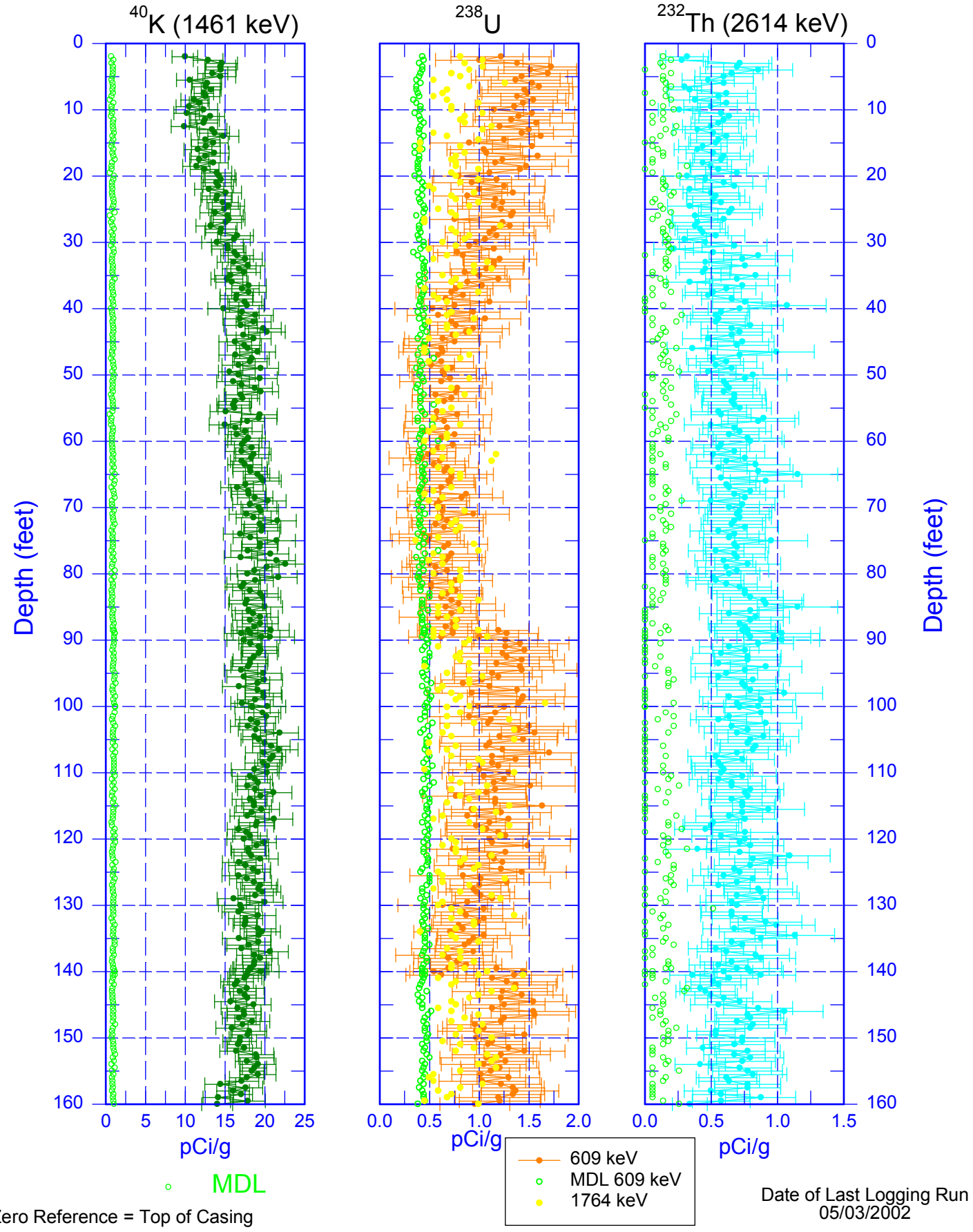
Man-Made Radionuclides



Zero Reference = Top of Casing

Date of Last Logging Run
05/03/2002

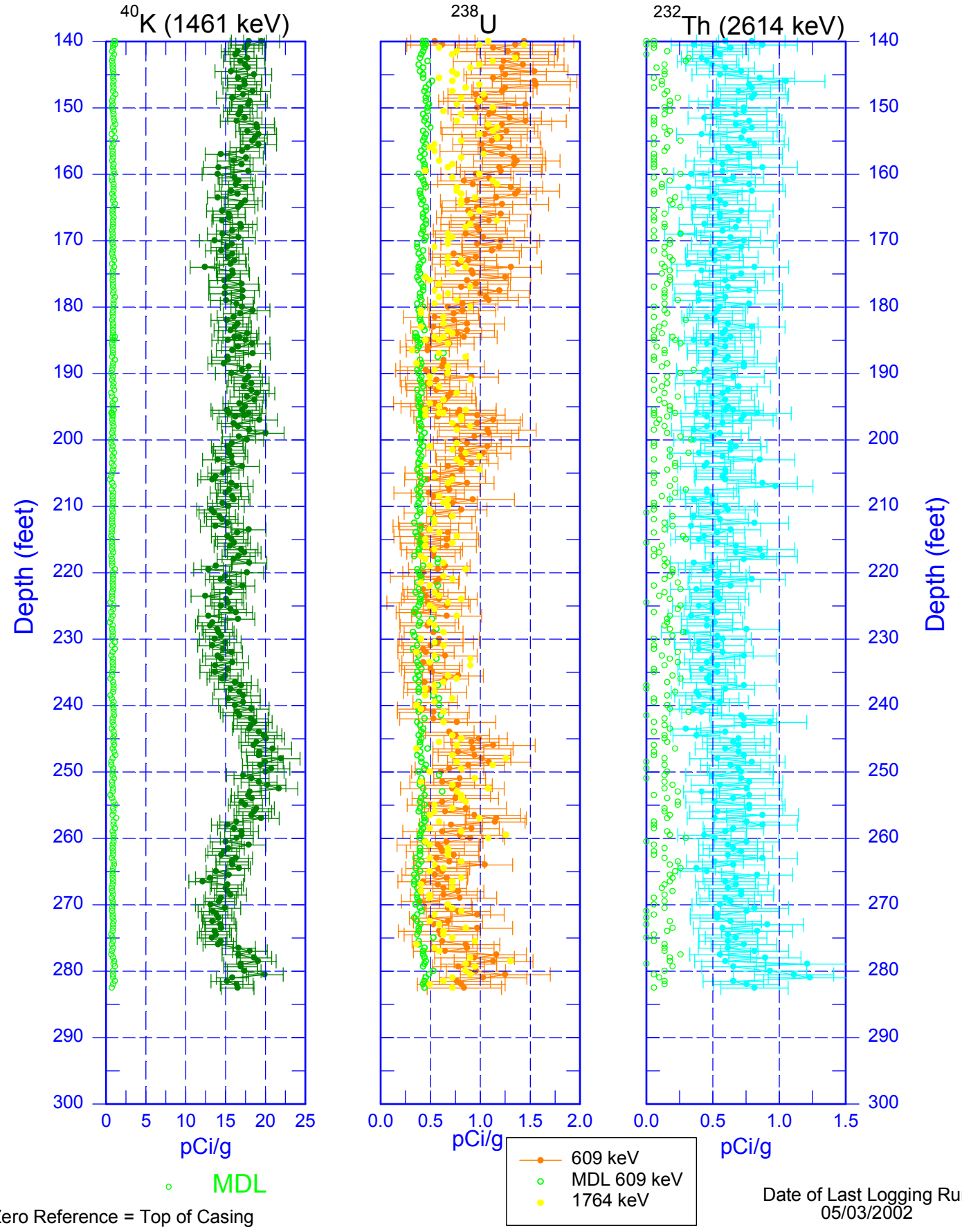
299-E28-3 (A6786)
Natural Gamma Logs



Zero Reference = Top of Casing

Date of Last Logging Run
05/03/2002

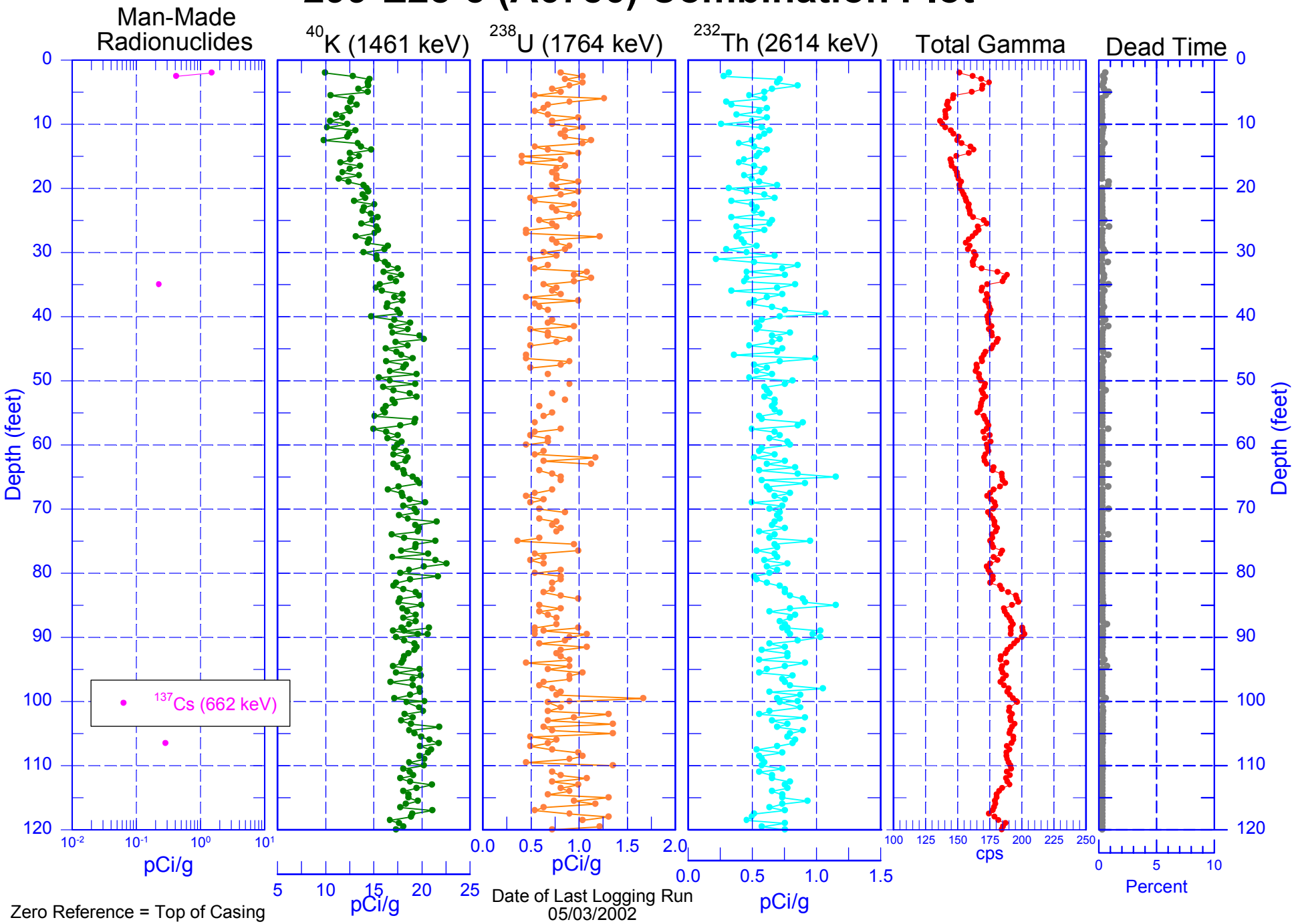
299-E28-3 (A6786)
Natural Gamma Logs



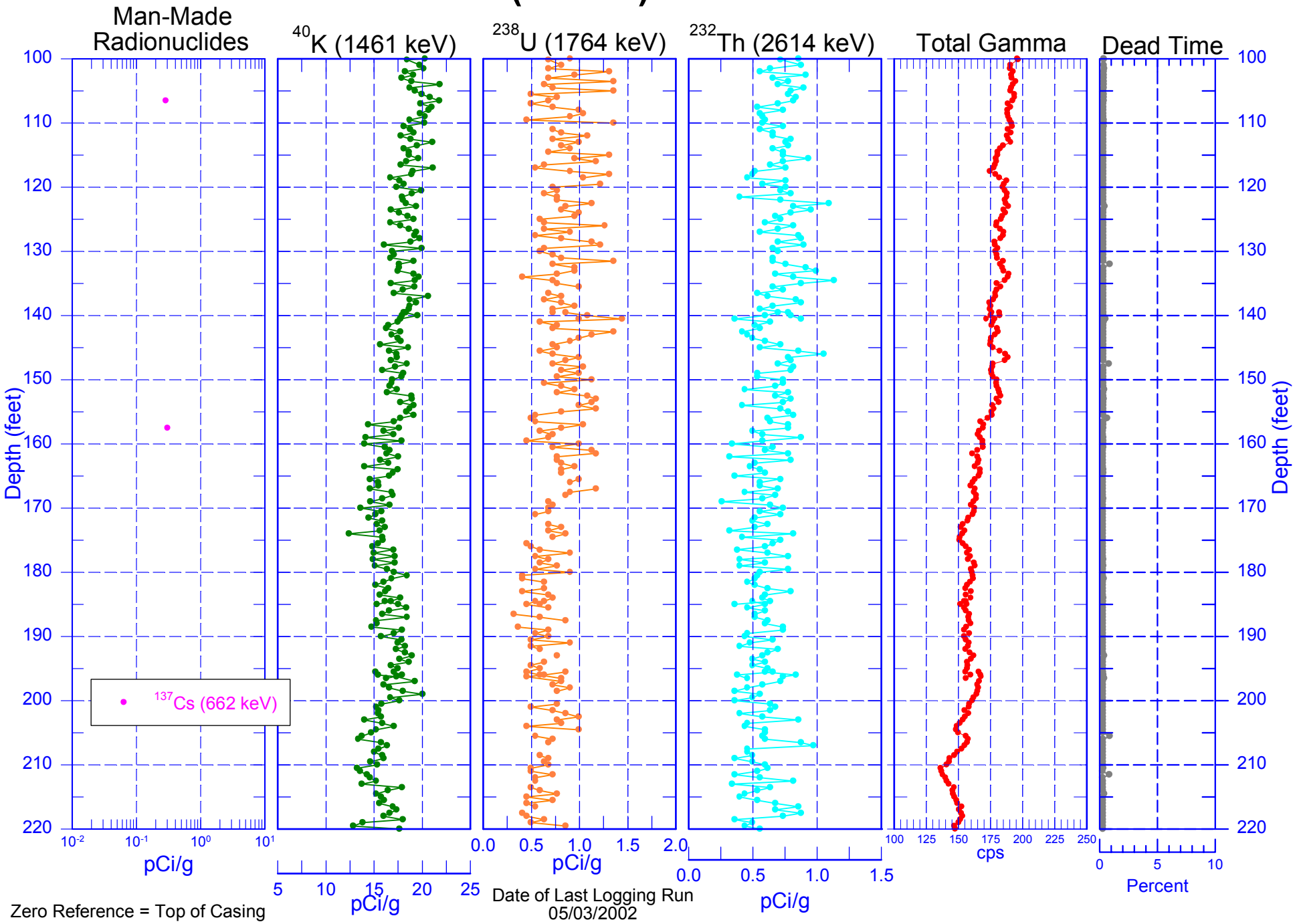
Zero Reference = Top of Casing

Date of Last Logging Run
05/03/2002

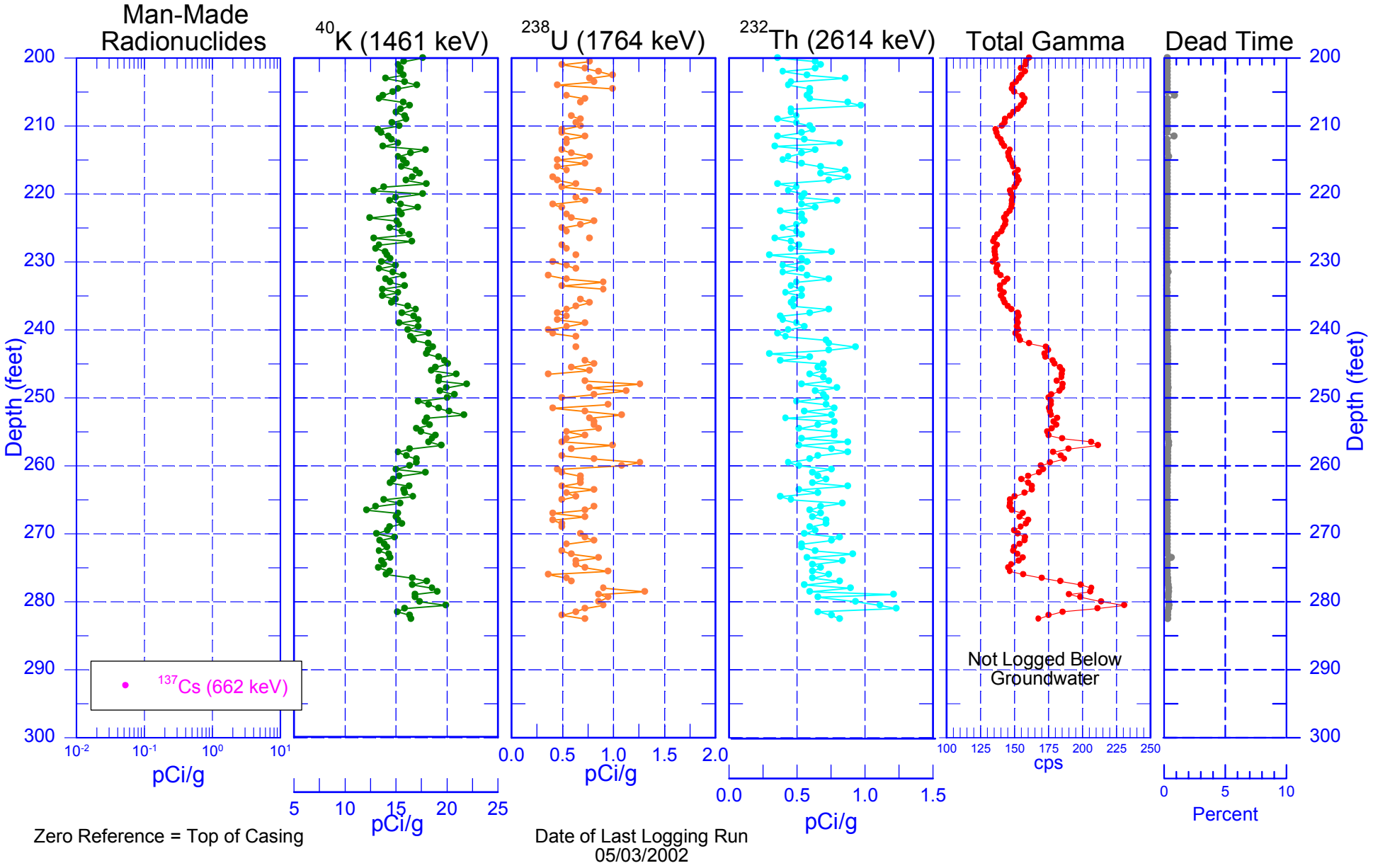
299-E28-3 (A6786) Combination Plot



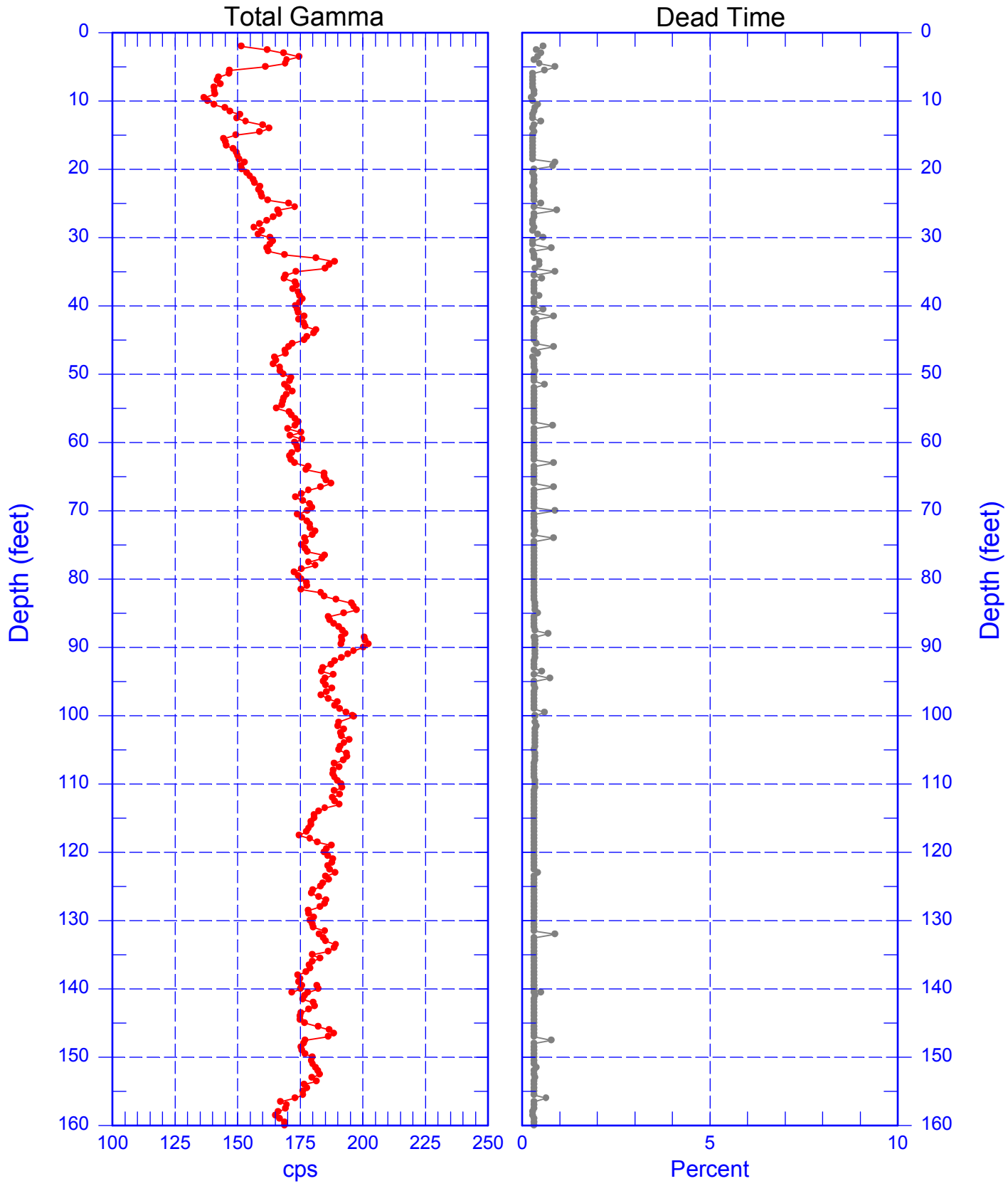
299-E28-3 (A6786) Combination Plot



299-E28-3 (A6786) Combination Plot



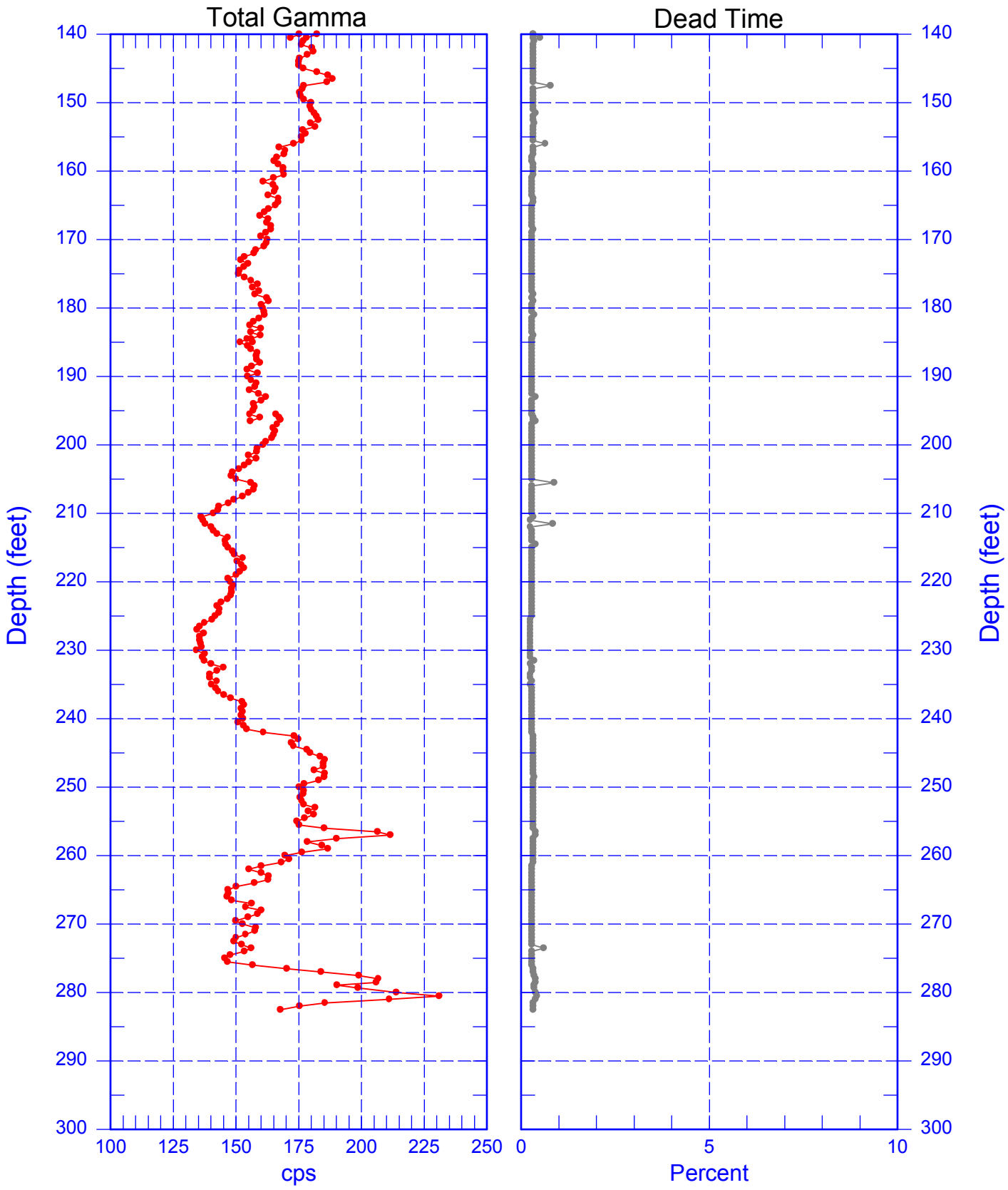
299-E28-3 (A6786)
Total Gamma & Dead Time



Zero Reference = Top of Casing

Date of Last Logging Run
05/03/2002

299-E28-3 (A6786)
Total Gamma & Dead Time

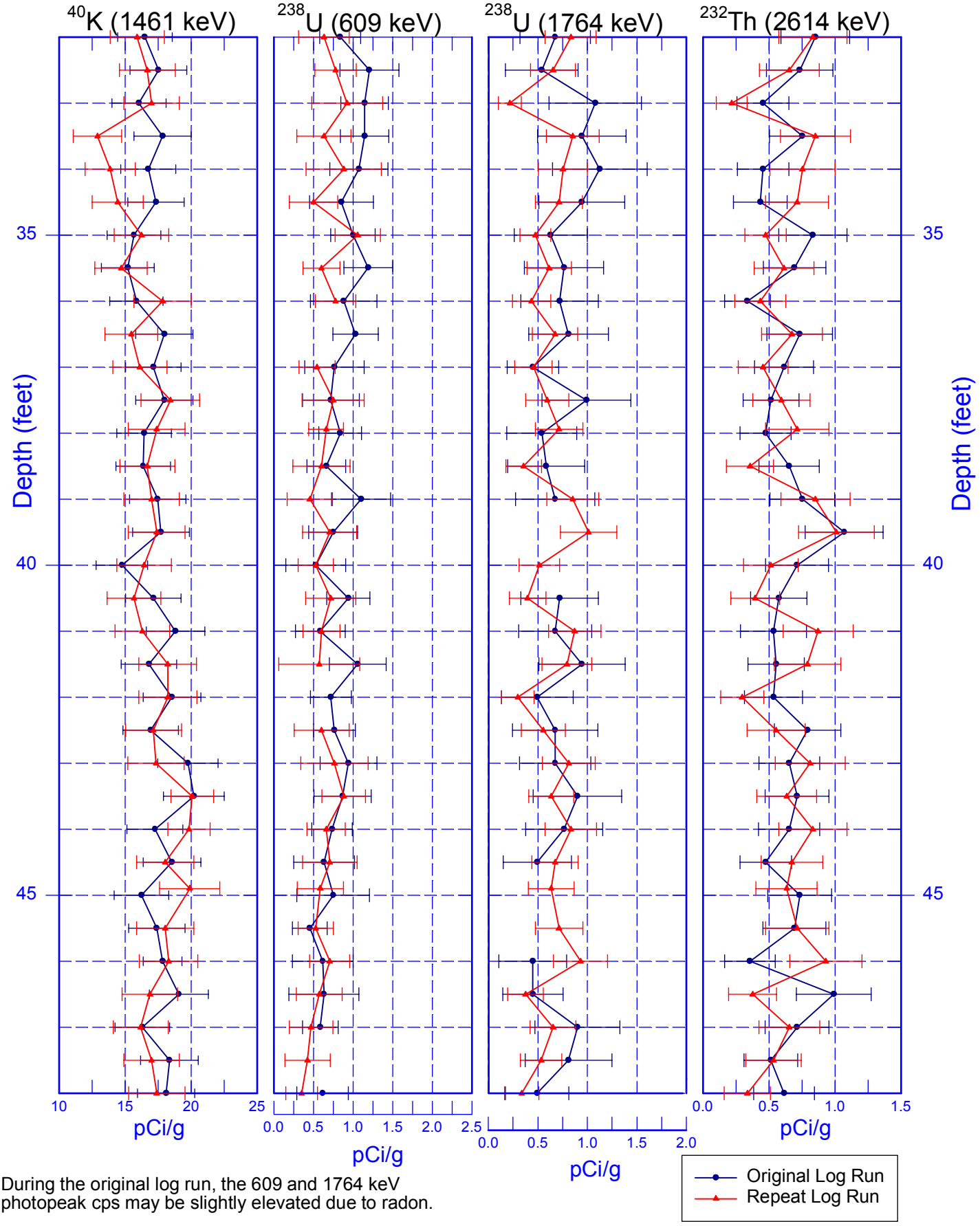


Zero Reference = Top of Casing

Date of Last Logging Run
05/03/2002

299-E28-3 (A6786)

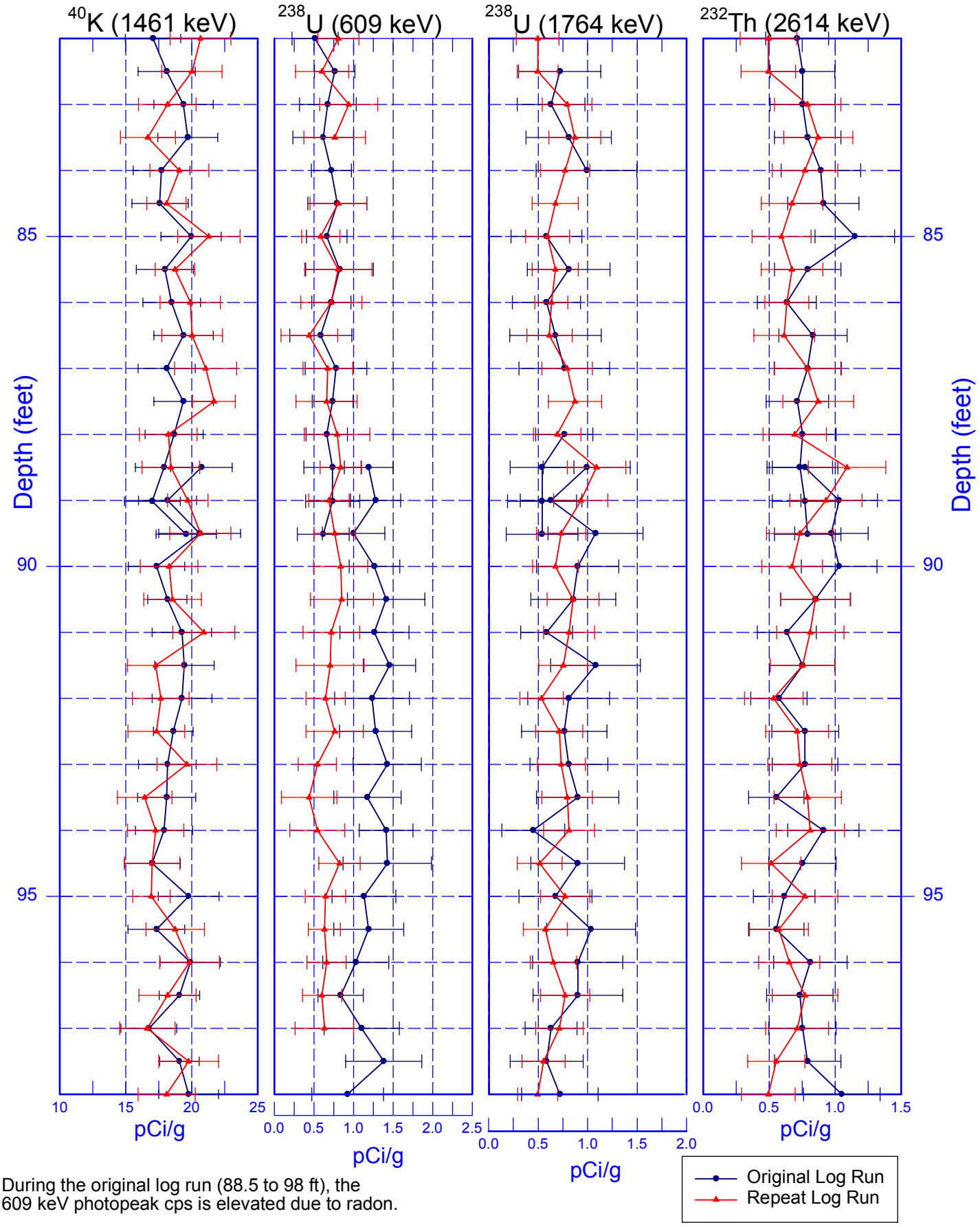
Rerun of Natural Gamma Logs (32.0 to 48.0 ft)



During the original log run, the 609 and 1764 keV photopeak cps may be slightly elevated due to radon.

299-E28-3 (A6786)

Rerun of Natural Gamma Logs (82.0 to 98.0 ft)



During the original log run (88.5 to 98 ft), the 609 keV photopeak cps is elevated due to radon.